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Long-term Results of Medial UKA for Knee Avascular Necrosis.

M.Ollivier^{1,2}
C. Jacquet^{1,2}
A.Lucet^{1,2}
S.Parratte^{1,2}
J-N Argenson^{1,2}

¹*Aix Marseille Univ, CNRS, ISM, Inst Movement Sci, Marseille, France*

²*APHM, Sainte-Marguerite Hospital, Institute for Locomotion, Department of orthopaedics and Traumatology, 13009, arseille, France*

✉ *Jean-Noël Argenson, M.D., Ph.D.*
Professor and Chairman of Orthopedic Surgery
Department of Orthopedics and Traumatology
St. Marguerite Hospital 270 Boulevard Sainte Marguerite BP 29 13274 Marseille, France
Phone: +33491745001
Fax: +33491745003
Email: jean-noel.argenson@ap-hm.fr (publishable)
Corresponding author and requests for reprints author.

**Long-term Results of Medial UKA for Knee
Avascular Necrosis.**

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27 **ABSTRACT:**

28 **Background :**

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30 Numerous series have documented short and Mid-term successes with cemented, Metal-
31 Backed modern unicompartmental knee arthroplasty (UKA) for avascular osteonecrosis of the
32 knee (AVN). However data are lacking regarding long-term implant fixation and patient
33 function. **The aim of this study was therefore to evaluate the long term clinical outcome**
34 **and implant survivorship of patients that underwent UKA for medial knee**
35 **osteonecrosis.**

36

37 **Methods:**

38 29 consecutive UKA performed by two senior surgeons (>50 UKA a year) in 28 patients (19
39 women and 9 men with a mean age of 67 years) with medial unicompartmental AVN of the
40 knee between 1989 and 2001 were retrospectively reviewed. AVN was diagnosed using x-ray,
41 MRI scan and finally confirmed by **postoperative** sample analysis
42 The mean patient body mass index was 27kg/m². Etiologies were spontaneous/idiopathic
43 AVN in 19 knees (66%) and secondary AVN in 10 knees (33%). The Mean follow-up was 21
44 years (15 to 26).

45

46 **Results:**

47 At 15 years survivorship of the components free of revision for any cause was 92% (95% CI
48 87 to 97). **At latest follow-up**, 26 years, survivorship of the components free of revision for
49 any reason was 83 % (95% CI 74 to 95). No survivorship difference was found between the
50 patients suffering from spontaneous or secondary ON of the knee (83% vs 90%, p=0.6). At
51 **latest follow-up** the mean Knee KSS was 89 points (range 68-100) and 83 (range 66-96) for
52 Function KSS.

53

54 **Conclusion:**

55 In the longest series to date, medial UKA for treatment of AVN was associated with high
56 survival rates and stable clinical improvement. UKA is a durable and efficient option to treat
57 patients with unicompartmental osteonecrosis of the knee.

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59 **Key Words : UKA; Avascular Osteonecrosis ; long-term results ; survivorship**

60 **Level Of Evidence :IV**

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78 **INTRODUCTION**

79 **Avascular osteonecrosis (AVN) of the knee is a devastating disease conducting without**
80 **appropriated treatment to severe osteoarthritis[1][2][3]. Conservative Surgical**
81 **Procedures such as core decompression, arthroscopic debridement, [4][5] or high tibial**
82 **osteotomy[6] are effective in the early stage of the disease, but when bone on bone**
83 **osteoarthritis occurs, a knee arthroplasty is often required [7][8][9][10][11][12][13]. To**
84 **replace involved compartment(s) Total Knee Arthroplasty (TKA) is a valuable option**
85 **but only unicompartmental knee arthroplasty (UKA) [14][15][10][16] allows selective**
86 **replacements of isolated medial or lateral compartment's necrosis.**

87 **To date, satisfactory patients' outcomes and implants' survivorship have been reported**
88 **in mid-term follow-up studies investigating on UKA performed for Knee**
89 **AVN[10][17][18][19]. However, data are lacking regarding long-term implant fixation**
90 **and patient function. The aim of this study was therefore to evaluate the long term**
91 **clinical outcome and implant survivorship of patients that underwent UKA for medial**
92 **knee osteonecrosis.**

93

94

95 **PATIENTS AND METHODS**

96 **Twenty-nine consecutive UKA, performed in twenty-eight patients, with unicompartmental**
97 **AVN of the knee, between October 1989 and June 2001, were retrospectively reviewed.**
98 **Institutional review board approval was obtained before starting the study.**

99 **The inclusion criteria included: minimum clinical follow-up of 15 years, confirmed**
100 **diagnosis of unilateral and isolated knee's medial compartment osteonecrosis; preserved**
101 **status of the patellofemoral and lateral tibio-femoral joints.**

102 **Indication for UKA included : preoperative range of knee flexion greater than 100°,**
103 **and full range of knee extension, a stable knee in the frontal and sagittal planes, finally**
104 **the possibility of full correction of the deformity to neutral (based on anteroposterior**
105 **varus and valgus stress radiographs) [19]. Of all patients seen for osteonecrosis of the**
106 **knee in the same period at our institution only 28 of 92 (30%) met the inclusion criteria.**

107 Nineteen women and nine men with a mean age of sixty-seven years (range, fifty-one
108 to eighty years) at the time of the UKA were included in this study. The mean patient body
109 mass index (BMI) was twenty-seven kg/m² (range, eighteen to thirty-five kg/m²).

110 **Bone osteonecrosis was diagnosed on x-ray and MRI scanner, then confirmed**
111 **postoperatively using an histologic analysis of bone samples. Preoperative magnetic**
112 **resonance imaging was used to confirm diagnosis but not to assess lesion size. MRI slides**
113 **were also used to detect any sign of patent osteonecrosis in the uninvolved**
114 **compartments.** The Mont et al [8] classification was used to describe joint space, bone
115 contours, and trabecular patterns.

116 According to this classification all patients in the study were graded Stage 4. The etiologies of
117 the AVN were spontaneous in 19 knees (66%) and secondary in 10 knees (33%). All surgeries
118 were performed according to a previously published procedure **by two senior surgeons**
119 **(performing >50 UKA a year)** through a medial para-patellar approach using a cemented
120 metal-backed tibial and a **cut-based type femoral implants** (Miller- Galante; Zimmer,
121 Warsaw, IN)

122 **This type of femoral implant (opposed to a resurfacing implant) allows to remove a**
123 **significant amount of the lesion. In terms of surgical technique, an extra-medullary road**
124 **with 2 metallic paddles linking the tibial and distal femoral cuts was used for all the**
125 **cases. As the wear on the tibial side is, often, very limited in AVN, the tibial paddle is**
126 **sitting high on the tibial side and consecutively artificially proximalizes the femoral cut.**

127 **This allowed to remove more AVN lesion on the femoral side without compromising the**
128 **extension gap. We also tried to select the biggest femoral size possible to cover as much**
129 **femur as possible and bridge the areas of AVN. A very careful curettage of the**
130 **remaining areas of AVN and a drilling (with a 2.7 mm drill) of the deepest part of the**
131 **defects was performed. After the cleaning of all the bony surfaces, a potential bone**
132 **grafting (using cancellous bone from the tibial cut) of the defects was done before the**
133 **final cementation of the implants cemented. In this series, autologous bone grafts were**
134 **used in 9 cases (30%).**

135 Clinical and radiographic evaluation was done at yearly intervals until the last follow-up. At
136 last follow-up the clinical evaluation was performed by an independent observer (XX).
137 Patients were asked to fill the Knee Society Scoring system (KSS) and Knee Osteoarthritis
138 outcomes score (KOOS) [20]. **Radiographic analysis was completed by two of the authors**
139 **not involved in the surgical interventions (XX and YY): on last follow-up x-ray, position**
140 **of the femoral and tibial components was assessed on AP and ML radiographs and**
141 **compared to postoperative position.** The presence, extent, or progression of femoral or
142 tibial radiolucencies was also recorded. **Progression** of osteonecrosis and/or osteoarthritis
143 were evaluated in the **lateral** compartment on AP radiographs and in the patello-femoral joint
144 on **merchant views**.

145

146 *Statistics*

147 Data are presented as mean values associated to standard deviation or range. The
148 Student's t-test was used for comparisons of continuous variables, implant survival was
149 estimated with use of the Kaplan-Meier technique [21]. Confidence intervals at the 95% level
150 were determined. Two end points were defined: (1) revision or implant removal for any

151 reason, including revision for septic and aseptic complications, (2) revision because of
152 progression of **osteonecrosis and/or osteoarthritis**.

153

154 *Sources of Funding*

155 There was no external funding source for this study.

156

157 **RESULTS**

158 No patient was lost to follow-up but four patients have died and 3 UKA were converted into
159 TKA during follow-up, leaving 21 patients (22 knees) with a clinical and radiological
160 evaluation of their implants at mean 21 years (range 15-26 years) after surgery.

161 *Survivorship*

162 At last follow-up available four knees showed non-progressive radiolucencies at the tibial
163 bone-cement interface. One femoral progressive radiolucencies was found and counted as
164 mechanical failure. **Four knees were converted into TKA, two due to progression of**
165 **osteoarthritis in the uninvolved compartments (at 12 and at 15 years) and Two due to**
166 **aseptic loosening of the implants (at 30 months and at 11 years).** Regarding our first
167 endpoint, at fifteen years survivorship of the components free of revision for any cause was
168 **92%** (95% confidence interval [CI] = 87 to 97%) (Fig. 1). Survivorship of the components
169 free of revision for progression of ON or osteoarthritis was 95% (95% CI = 91 to 99%).

170 At latest follow-up, 26 years, survivorship of the components free of revision for any reason
171 was 83%(95% confidence interval [CI] = 74 to 95%).

172 Survivorship of the components free of revision for progression of AVN or osteoarthritis
173 89% (95% CI = 82 to 96%).

174 No survivorship difference (free from revision for any cause) was found between the patients
175 suffering from spontaneous or secondary ON of the knee (83% vs 90% and p=0.6) *as well as*

176 *for patients requiring bone grating because of important subchondral defect (78% vs 90%*
177 *p=0.4).*

178

179 *Clinical Outcome*

180 At last follow-up mean Knee KSS was 89 points (range 68-100) and 83 (range 66-96) for
181 function KSS. The mean improvement was 33 points (range 11-48 points) for the knee score
182 (p<0.0001) and 33 points (range 22-58 points) for the function score (p<0.0001). The results
183 of the KOOS at last follow-up are presented in Figure 2.

184

185 **DISCUSSION**

186 The purpose of the present study was to evaluate the long-term results of cemented
187 UKA for treatment of medial knee compartment osteonecrosis. After a 15-year follow-up, we
188 found a ninety-five percent survivorship free from any reason and eighty-nine percent after 26
189 years.

190 Only few studies provided data on the long-term results of UKA for ON

191 [19][22][23][18][15][10][24][17][25]; The mean follow-ups of these reports vary between 4,5
192 and 10,9 years. These studies reported survivorship rates between 76 and 100%. In our series
193 15 to 26 years survivorship free from revision for any cause ranged from 95 to 89%. **Only**
194 **few studies investigated on survivorship of UKA for ON with a follow-up superior to ten**
195 **years (Table1) and comparison of our result to existent literature is limited.** Heyse et al.
196 [17] provided data at 10,9 years, survivorship of UKA free from revision for any cause was
197 similar to our series (93,1% at ten year vs 95% at fifteen years).

198 Bruni et al. studied the largest series of UKA for ON with 84 patients followed during an
199 average of 8.2-year. The survival rate at 10 years was 89%. Our survival rates seem superior
200 to those of Bruni et al., however, they reported eight mechanical failures on the tibial side of

201 their full-polyethylene UKA. The exclusive utilization of metal-backed UKA in our series
202 may explain these survival differences. The results of a recent study of Pandit et al. [26]
203 investigating on **ten years results of 1000 Oxford UKAs**, highlights implants' good
204 survivorship of modern implants: 94% at 10 years and 91% at 15 years. The pathological
205 diagnosis was osteoarthritis for 98% and ON for 2% of the patients.

206 **In their recent study Chalmers et al. [25] obtained lower survival rates than those**
207 **reported in our series (89% at 5 years and 76% at 10 years). Our two populations**
208 **present a major difference that makes comparison difficult to draw (Mean BMI**
209 **respectively 31 vs 27 kg/m²) as BMI is a potential risk factor for early implants' revision**
210 **[27]. Their series also included 2 lateral UKAs whose survival rates are described to be**
211 **inferiors to medial UKAs [28]. Those differences, as well as the limited number of failure**
212 **observation in our two series might explain why Chalmer et al [25] found higher**
213 **revision rate for patients suffering from secondary osteonecrosis when our two**
214 **subgroups (primary and secondary AVN) exhibited similar 15 years results.**

215 At latest follow up, we found a mean KSS function of 83 points and 89 points for the
216 KSS Knee. These results are inferior (as our patients are older) than clinical scores we had
217 reported at 12 years follow up for the same series (KSS function was 95 and KSS Knee was
218 88). Heyse et al.[17] have similar result in a series of 66 UKA for ON at 10.9 follow up with
219 81 for the KSS function and 92 for the KSS Knee. **Pandit et al. [26] found a mean KSS**
220 **knee of 80 and a mean KSS function of 76, which is slightly inferior to the clinical score**
221 **of our study.**

222 Only few series compared long-term results of UKA versus TKA in the treatment of
223 ON[11][10]. Only one them gave advantages to TKA: Radke et al. [11] compared 23 UKA to
224 16 TKA. For patients with more than 5 years follow-up, function and pain scores were better
225 for the TKA group. Furthermore, 4 patients in the UKA group were revised versus 0 in the

226 TKA group. The authors explain this result by better fixation of TKA implant in necrotic
227 lesion and a lack of secondary arthritic and potential osteonecrotic transformation of further
228 knee compartments. Thus, inclusion criteria for UKA were not clearly defined by the authors.
229 Myers et al. compared UKA and TKA for patients suffering from osteonecrosis. Considering
230 outcomes of modern implants only, they showed no difference neither on survivorship nor on
231 clinical scores after 8-year follow-up [10].

232 The long-term results of UKA for osteonecrosis are comparable to UKA for osteoarthritis
233 [29][22][24]. Servien et al [22] and Langdown et al [24] compared the patients undergoing
234 UKA for two indications with respective follow-ups of 4,5 and 5 years: they did not show
235 any clinical or implants' survival differences.

236 **When performing UKA for knee AVN, the choice of the implants is, in our experience,**
237 **detrimental. First to remove as much of the lesion as possible, we prefer cut-based**
238 **femoral implants allowing broader necrotic areas resection. Then, to improve the bone-**
239 **implant contact-surface, we always select the biggest femoral size. Finally, on the tibial**
240 **side, as the wear is often less important than in standard arthritic knees, bone's cut**
241 **should be minimal to ensure adequate bone quality below the implant (and avoid early**
242 **subsidence).**

243 **Some limitations should be outlined in the current study. Foremost, the retrospective**
244 **design of the series, limits extrapolation of our results, but the prevalence of medial**
245 **compartment ON of the knee in the general population also limits prospective data**
246 **collection with a sufficient number of patients. Our sample size is thus modest but**
247 **represents a ten-year inclusion period in a high-volume institution. Even though this**
248 **study is retrospective, no patient was lost to follow-up. Only four patients died. All dead**
249 **patients had no pain on their knee and died for reasons unrelated to UKA surgery, with**
250 **the implants still in place. Another limit of this study is its non-comparative nature, we**

251 aimed in this protocol to estimate knee function and implant survivorship of patient
252 undergoing a UKA for ON of the knee. Despite these limitations, to our knowledge,
253 there is no other study, investigating specifically on UKA for treatment of ON, providing
254 clinical and radiological results with such a long follow-up track record.

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258 **Conclusion**

259 In the longest series to date, cemented medial UKA for treatment of ON was associated with
260 high survival rates and stable clinical improvement. UKA is a durable and efficient option to
261 treat patients with unicompartmental osteonecrosis of the knee.

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Studies	Number of patients	Age (years)	Mean Follow up (years)	Survivorship	KSS	Other score
Bruni et al [1]	84 UKA AVN	66	8.2	89% at 10 years	87.1	
Marmor et al[2]	34 UKA AVN	68	5.5	88.3%		
Servien et al[3]	33 UKA AVN 35 UKA OA	74	4.5 5.1	95.4% 92.8 %		No IKS Difference
Parratte et al [4]	31 UKA AVN	71	7	96.7% at 12 years	K : 95 F :88	
Myers et al [5]	10 UKA AVN 52 TKA AVN	39	8	100% 96%	91 94	
Langdown et al [6]	29 UKA AVN 28 UKA OA	71	5	100% 100%		OKS=38 OKS=40
Heyse et al [7]	52 UKA ON	66	10.9	93.1% at 10 years 90.6% at 15 years	K : 92 F :81	WOMAC= 7.7
Chalmers et al [8]	45 UKA AVN	66	5	89% at 5 years 76% at 10 years		IKS preoperatively 60 IKS postoperatively 94
This study	29 UKA ON	67	21	95% at 15 years 89% at 26 years	K :89 F: 83	

Table 1. Summary of Literature in the Treatment of Knee avascular osteonecrosis using UKA

UKA : unicompartmental knee arthroplasty

AVN : avascular osteonecrosis

OA : osteoarthritis

WOMAC : Western Ontario and McMaster Universities Arthritis Index

IKS : International knee society score

KSS : Knee Society Score K: Knee F: Function

OKS : Oxford Knee Score

1 FIGURES LEGEND.

2 **Figure 1.** Kaplan-Meier survivorship curve showing fifteen-year survivorship free from
3 any reason to be 92 per cent.

4 **Figure 2.** Illustrating the KOOS evaluation at last follow-up available.

5 **KOOS :** Knee injury and Osteoarthritis Outcomes Score

6 **ADL :** Activity of Daily Living

7 **QOL :** Quality Of Life.

8

9

KOOS subscores



